

Update on Continent Catheterizable Channels and the Timing of Their Complications

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Purpose: We previously reported catheterizable channel associated outcomes and concluded that the incidence of postoperative complications was greatest in the first 2 years after surgery. At that time our followup was short. In this series we sought to determine whether complications continued to accumulate with longer followup in an updated cohort of patients.

Materials and Methods: We comprehensively reviewed the outcomes in 81 consecutive patients who underwent construction of a MACE (Malone antegrade continence enema) and/or a Mitrofanoff channel in association with complex genitourinary reconstruction. Mean followup was 80.1 months. Outcomes of these 119 stomas were classified by Clavien-Dindo grade and time to complication.

Results: The 48 unique, channel related events (40.3%) necessitated a total of 70 interventions with a mean 24.2 months to the first event. Difficult catheterization was the most common event, occurring in 20.1% of channels an average of 29.9 months after surgery. Stomal stenosis was also common, developing in 12.6% of channels at an average of 19.9 months after surgery. Unique complications clustered in the first 2 years, after which there was a statistically significant decline ($p = 0.0013$). High grade complications similarly clustered ($p < 0.0001$). Channel composition was significantly associated with rates of difficult catheterization events.

Conclusions: Compared to our previous cohort of patients with similar volume but shorter followup, our assumption that channel associated complications cluster postoperatively and then decrease significantly was correct. Our current and more detailed series demonstrates that the rate of postoperative complications decreases with time. However, with longer followup patients continue to experience lower grade events requiring fewer interventions.

Key Words: urinary diversion, catheterization, postoperative complications, fecal incontinence, surgical stomas

THE introduction of the Mitrofanoff catheterizable appendicovesicostomy in 1980 allowed for significant improvement in the management of complex pediatric lower urinary tract reconstruction.^{1,2} Since that time, retrospective analyses of institutional outcomes data have sought to define

the incidence of channel associated complications, such as difficult catheterization, stomal stenosis, stomal incontinence, false passages and stomal prolapse.

We have previously reported channel associated complications.³ At a mean of 28.4 months of followup,

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postoperative complications developed in 23% of the 117 channels in our cohort of 78 patients, of which all occurred prior to 24 months. Given that our followup was short, we questioned whether continent stomas function well after the initial period of healing or whether postoperative complications continue to accumulate with longer followup.

To our knowledge the current study is unique as we captured every channel related event and not just the initial complication. The current series also represents the first application of the Clavien-Dindo system to an analysis of channel associated complications to stratify the level of intervention required.

MATERIALS AND METHODS

Institutional review board approval was obtained. Patients undergoing channel construction in association with complex genitourinary reconstruction at our institution between February 2002 and February 2014 were identified by CPT codes 51535, 51800, 51820, 51940, 51960, 50830, 50845 and 53431. Each entry was retrospectively reviewed and all children younger than 20 years who underwent construction of a MACE or a Mitrofanoff channel were included in analysis.

All channels were created in patients undergoing concomitant bladder augmentation, redo bladder augmentation or formation of a bowel urinary reservoir. Patients undergoing a catheterizable channel alone were excluded from study. Thus, we established a cohort of 81 patients in whom the perioperative and postoperative course was comprehensively documented beginning 1 year prior to surgical intervention and ending on January 15, 2015.

All chart entries were analyzed, including: inpatient notes from all services, outpatient notes from all services, clinic summaries, records from elsewhere scanned into the medical record, imaging studies, laboratory values and objective growth measurements. Any event related to the index procedure was documented with attention to time course, channel type, tissue type and Clavien-Dindo grade (supplementary Appendix, <http://jurology.com/>).

Clavien-Dindo grading was determined by consensus and graders were blinded to patient identifiers. The first event encountered or any event that occurred at least 90 days after the last intervention was termed a unique complication. Any event requiring intervention was also documented and stratified by Clavien-Dindo grade.

The log rank test and Cox regression were used to compare the incidence of unique complications by year. The Fisher exact test was used to compare the rate of complication associated with ileal vs appendiceal channels.

RESULTS

We constructed a total of 119 channels in 81 patients with an average 80.1 months of followup. Of our patients 82.7% were Caucasian and the

median age was 8.4 years at the initial intervention. The primary diagnosis was spina bifida in 56.8% of patients. Other common diagnoses included exstrophy/epispadias/cloaca in 18.4% of cases, sacral agenesis/caudal regression/tethered cord in 9.9% and posterior urethral valves in 6.2%. Of the channels 74 (62.2%) were Mitrofanoff channels and 45 (37.8%) were MACE channels. A total of 38 patients (46.9%) underwent creation of both a Mitrofanoff and a MACE channel. All channels were created in patients undergoing concomitant bladder augmentation, redo bladder augmentation or formation of a bowel urinary reservoir.

Mitrofanoff channels were constructed from appendix in 45.9% of cases, ileum in 44.6%, bladder in 6.8%, ureter in 1.4% and sigmoid colon in 1.4%. In general, if appendix was available, it was preferentially used to construct a Mitrofanoff limb. MACE channels were constructed from appendix in 95.6% of cases and cecum in 4.4%. In 7 patients a split appendix was used to create both channels.

Overall, 48 unique complications necessitated a total of 70 interventions at a mean of 24.2 months in our patient cohort. Of the channels 40.3% and approximately 50% of our patients experienced at least 1 unique complication while 6 patients had 2 or more unique complications each. The most frequently reported complication, that is difficult catheterization, was documented in 20.1% of channels at a mean 29.9 months for a total of 41 interventions. Of the difficult catheterizations 14 were Clavien 3B. Those interventions included cystoscopy with or without dilation in 9 cases, Chait® tube manipulation in 2, suprapubic tube placement in 2 and granuloma excision in 1.

Stomal stenosis was documented in 12.6% of channels at a mean 19.9 months, requiring a total of 18 interventions. Stomal incontinence was documented in 4.2% of channels at a mean 23.1 months for a total of 7 interventions. False passages and stomal prolapse were each documented in 1.7% of channels at a mean 28.2 and 17.0 months, respectively. Of 48 complications 29 (60.4%) and 39 of 70 interventions (55.7%) were Clavien-Dindo grade 3A or 3B events, which required surgical repair. The table shows a breakdown of our institutional outcomes stratified by complication type, number of complications/interventions, associated tissue type and Clavien-Dindo grade. [T1]

Channel associated complications were further stratified by bowel type. Either ileum or appendix was used to create 92.4% of stomas and the complication rates associated with each were compared. A total of 20 ileal channels, representing 60% of all channels and a total of 33 interventions, vs 22 appendiceal channels, representing 28.6% of all channels and a total of 31 total interventions,

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